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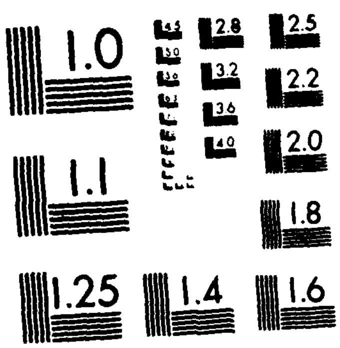
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Equipment was purchased to support research in two main areas: communication channels with memory and signal detection and classification problems involving non-Gaussian stochastic processes. The research on communication shannels involves largely the study of channel capacity under various assumptions and constraints. The research in signal detection and classification includes modeling, data analysis, and the development and evaluation of detection algorithms.

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FINAL REPORT

for

INFORMATION AND STOCHASTIC SYSTEMS

AFOSR EQUIPMENT GRANT AFOSR-87-0106

Dod URIP Control No.: 860765

Charles R. Baker

Department of Statistics

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina 27514

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Summary

This is a final technical report on AFOSR equipment grant AFOSR 87-0106. The list of equipment actually acquired is included. Also included is a brief discussion of research on which the equipment will be used.

The major items of equipment have recently been received. Thus, the discussion of research will summarize the work to which the equipment will be applied.

Research

The research projects on which the equipment will be used lie in two main areas: communication channels with memory (including channels subject to jamming), and signal detection/classification problems involving nonGaussian stochastic processes.

The research on communication channels involves largely the study of channel capacity under various assumptions and constraints. The work includes channels with feedback, multiaccess and broadcast channels, Gaussian and non-Gaussian channels. A primary distinguishing feature of this work is that it is primarily focused on channels with memory. Most of the research that has been carried out thus far has been of a theoretical nature. The future research in this area is expected to involve more computational work. One potential aspect of such work is the Monte Carlo evaluation of decoding algorithms when the channel noise is unknown. This work can be expected to utilize actual experimental data. Thus, decoding error can be estimated for a given code word length, and compared with the results that would be obtained with the noise process known.

The new equipment will greatly improve the research program's capability in the area of signal detection and classification. That work already includes modeling, data analysis, and the development and evaluation of detection

algorithms. Included in these areas are some rather significant problems; for example, the simulation of diffusion processes, the estimation of the drift function, and approximation and evaluation of likelihood ratios based on using the estimated drift, rather than the true drift. The work on diffusions forms a central part of our effort to develop a detection algorithm for nonGaussian random signals imbedded in additive Gaussian noise. This is already a major problem in some important DoD applications, and can be expected to be an important problem of the future. The thrust of the ISS research work is toward finding signal detection/classification algorithms that do not require exact knowledge of the signal-plus-noise statistics, although it is assumed that one can learn the noise statistics.

Also included in the detection and classification computational work are efforts on modeling, data analysis, and algorithm evaluation using experimental data. These efforts have been structured by developing a battery of programs, beginning with statistical tests for various data characteristics, ending with Monte Carlo programs for algorithm evaluation. The new equipment will enable these programs to be run much faster, and without the many problems attendant to having limited memory and storage capability.

The ISS work in both the two major areas of work (communication channels with memory, and nonGaussian signal detection/classification) is rather unusual in the spectrum of work being carried out in these areas. Beginning with very general mathematical models, theoretical solutions are sought in this generality. However, the object of developing the dedicated computer facility has been to move these theoretical results from the form of theorems to the form of algorithms with serious potential for engineering applications. The new equipment funded by AFOSR should be a significant aid toward accomplishing this objective.

EQUIPMENT PURCHASED

Item	Price
Equipment Purchased from Sun Microsystems, Inc.	
Data Center Server Computer, 4/280S-32R1	$32,062
Deskside computer workstation, 4/260-HM-P1	52,312
Desktop computer workstation, 3/60FC-4-P1	10,058
575 MB formatted disk subsystem, 625AR1	15,458
16-channel asynchronous line multiplexer, 481B	3,071
6250/1600 bu ½-inch tape drive, 675AR1	11,408
Data center cabinet, 960A	2,632
Integrated Personal Computer, Sun IPC-87	1,320
Floppy disk drive, Sun IPC-FPY-02	696
High-resolution monitor, keyboard and mouse, 252A	3,038
Software for SUN IPC Board, Sun IPC-01	495
Software distribution, SYS3-02	315
Software distribution, SYS3-01	304
Transceiver ethernet, TAP	500
Ethernet tool, ETH-TAP-TOOL	75
Laserwriter interface kit, LW-INT-02	1,800
Equipment Purchased Elsewhere	
Applewriter plus printer (vendor: UNC Student Stores)	4,058
Toshiba 3100 portable computer, with accessories (vendor: D-Data)	3,689
FRAME MAKER technical work processing/graphics software (vendor: FRAME Technology Corp.)	1,090
Math Advantage Scientific Subroutines for Sun computers (vendor: Quantitative Technology Corp.)	1,400

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